

# Geography Education for Pre-School to K-8 Children using Mobile Technologies –A High-Fidelity Prototype

Maksood Mohiuddin

Student

Online MS in Computer Science

Georgia Institute of Technology

Atlanta, GA

maksood@gatech.edu

## ABSTRACT

Amalgamation of intelligent tutoring systems, game based learning and simulation based learning in a mobile app can be effective way to engage preschool to K-8 student in geography education. Research on different mobile-based learning technologies on geography education has been studied, and the findings have been incorporated in a technical prototype built for Apple iOS platform and Google Android platform.

## 1 INTRODUCTION

I have explored how pedagogical technologies can augment educational experiences. I have studied four areas of education technologies that I am particularly interested in: intelligent tutoring systems, game based learning, mobile devices and simulation based learning. Upon further inspections of these four areas of educational technologies, I have determined amalgamation of the four technologies as multi-channel learning experience can be an effective learning tool.

I have explored areas where my interest of using multi-channel learning experiences can be leveraged to contribute to education technologies ecosystem particularly for preschool and grades 1 to 8 kids. After reviewing the existing educational marketplace for preschool and preschool and grades 1 to 8 kids. I have decided to build a high-fidelity prototype (M. Walker, 2002) of an interactive mobile app for kids to learn geography.

## 2 PEDAGOGICAL TECHNOLOGIES

### 2.1 Intelligent Tutoring Systems

An intelligent tutoring system (ITS) is computer software designed to simulate a human tutor's behavior and guidance. It can assist students studying a variety of subjects by posing questions, parsing responses, and offering customized instruction and feedback.

In Carnegie Mellon University, researchers developed an intelligent tutoring system called the LISP Tutor in the mid-1980s that taught computer programming skills to college students. In one controlled experiment, students who used the ITS scored 43 percent higher on the final exam than a control group that received traditional instruction. When given complex programming problems, the control group required 30 percent

more time to solve these problems, compared to the ITS students. (Ramachandran, 2000)

### 2.2 Game Based Learning

Game based learning broadly refers to the use of game playing to support teaching and learning. The implications of delivering game experiences for education and training are enormous. In the US, nearly 170 million people played computer and videogames in 2008, spending a record \$11.7 billion. By harnessing the power of well-designed games to achieve specific learning goals, we can motivate to avidly engage with and practice applying problem-solving skills. (Trybus, 2009)

In an effective game based learning environment, student make mistakes in a risk-free environment and through experimentation, actively learn and practice the right way to do things. Game based learning environment keeps us highly engaged in practicing behaviors and thought processes that we can easily transfer from the simulated environment to real. Research supports the effectiveness of game-based learning in virtual environments—for example, according to a meta-analysis of flight simulator training effectiveness, simulators combined with aircraft training consistently produced training improvements compared to aircraft-only training.

### 2.3 Simulation Based Learning

Simulation based learning includes instructional elements in a simulation that are based of some reality. Simulation based learning helps learner explore, navigate or obtain more information about that system or environment that cannot generally be acquired from simple experimentation.

Empirical study suggests there are effectiveness in simulation based learning experience One such study (Chou, 2013), students participated in a currency trading game of the euro against the dollar using a web based simulation. Multiphase results were collected through three game phases: the beginning of the game, the middle of the game, and the end of the game. The findings show that the web-based simulation game enhanced students' understanding related to currency trading.

### 2.4 Mobile Devices

Mobile devices are ubiquitous and can be a powerful educational technology. Huizega et el research demonstrated

that use of mobile games in education combines active learning with fun. Their research tracked the effects of a mobile city game called Frequency 1550, which was developed by The Waag Society to help students in their first year of secondary education playfully acquire historical knowledge of medieval Amsterdam. The benchmark of the research was student engagement in the game, historical knowledge, and motivation for history in general and the topic of the Middle Ages in particular. A quasi-experimental design was used with 458 students from 20 classes from five schools. The student in 10 of the classes played the mobile history game whereas the students in the other 10 classes received a regular, project-based lesson series. The results showed those students who played the game to be engaged and to gain significantly more knowledge about medieval Amsterdam than those pupils who received regular project-based instruction (Huizenga, 2008)

### 3 MINIMAL VIABLE PRODUCT (MVP)

#### 3.1 Coloring and/or Drawing Ability

The technical prototype will incorporate challenges and curiosity aspect of learning by the ability to color and/or draw on the map of randomly selected states in a canvas. MVP will include ability to select a variety of color to draw and/or color with, impose text over the image and undoing ability. According to a research on game based learning, computer games that provide challenge, include elements of fantasy, and rouse the curiosity of the learners are intrinsically motivating (Malone, 1980).

#### 3.2 Various Geographic Information About

The technical prototype will include element of controls as an immersive learning experience by providing ability to select a state and learn more about that state – particularly geographic information about states. The MVP will include: State Map, State Capital, Nick Name of the state and Bordering States

Research by Lepper suggests that young learners should have opportunities for making choices about instructionally irrelevant aspects of the activity such as types and names of characters and fantasy elements to truly involve in the learning (M.R. Lepper, 1987).

#### 3.3 Geo-Location and Track State Colored/Drawn

The app will include simulated puzzle based learning by incorporating the ability to use geo-location to track current state the user is located at and track previously colored/drawn states. A study indicates that students who enroll in puzzle based courses perceive an improvement in their thinking and general problem-solving skills. (Falkner, Sooriamurthi, & Michalewicz, 2010)

## 4 LOW FIDELITY PROTOYPE SURVEY AND RESULTS

I have conducted a survey of a low fidelity prototype I have built to receive feedback on how can I improve the technical prototype. The survey involved watching the demo video of the low fidelity prototype and then answer a few follow-up survey questions. I have received 60+ responses for the survey from my peers and figures 1-7 contains the graphical representations of the survey result.

Do you live in a household with preschool or school going (K-12) kids?

62 responses

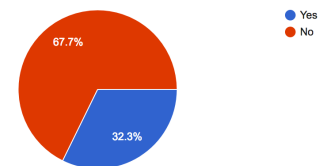


Figure 1: Household

Do you or anyone in your household use mobile app for educational purpose?

62 responses

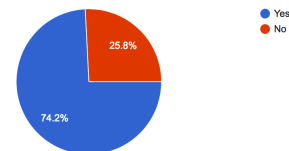


Figure 2: Educational Purpose

After watching the demo video, do you think you will recommend or use mobile app for educational purposes?

62 responses

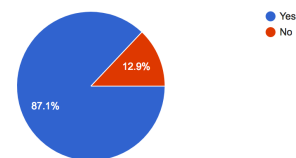
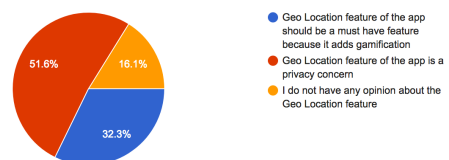


Figure 3: Recommendation

After watching the demo video, you think...

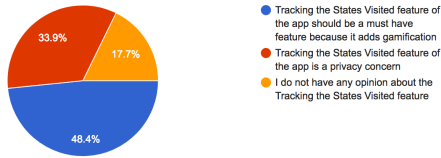
62 responses



**Figure 4: Geo Location**

After watching the demo video, you think...

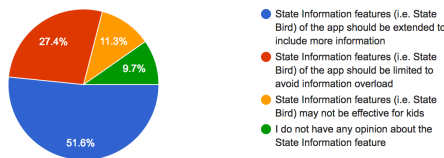
62 responses



**Figure 5: State Colored**

After watching the demo video, you think...

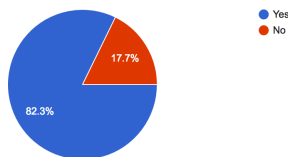
62 responses



**Figure 6: State Information**

After watching the demo video, do you think the app should build the coloring capabilities over the state map?

62 responses



**Figure 7: Coloring Capability**

## 5 HIGH FIDELITY PROTOTYPE

I have built a high-fidelity prototype to engage preschool to K-8 student in geography education based on minimal viable product design and survey results. The technical prototype is of an interactive educational mobile app that amalgamates concepts from intelligent tutoring systems, game based learning and simulation based learning. Figures 8-16 contains the graphical screenshots of the technical prototype built for Apple iOS platform. Figures 17-23 contains the graphical screenshots of the technical prototype built for Google Android platform



**Figure 8: iOS App Launcher Icon**



**Figure 9: iOS Color Tab State**



**Figure 10: iOS Color Tab Palette**



**Figure 11: iOS Color Tab Colored State**

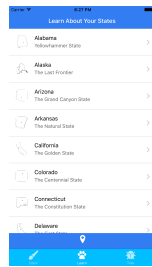


Figure 12: iOS Learn Tab State Selection



Figure 16: iOS Trek Tab State Colored

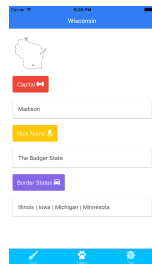


Figure 13: iOS Learn Tab Selected State

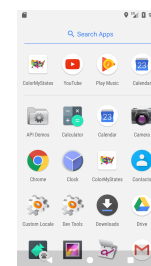


Figure 17: Android App Launcher Icon

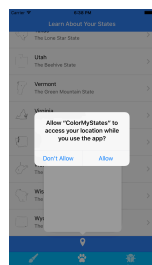


Figure 14: iOS Learn Tab Geo-Location Prompt



Figure 18: Android Color Tab State

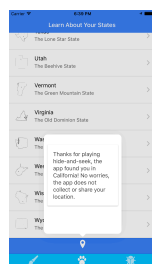


Figure 15: iOS Learn Tab Geo-Location



Figure 19: Android Color Tab Palette



Figure 20: Android Color Tab Colored State

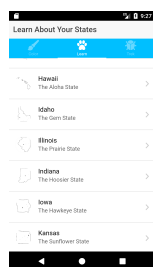


Figure 21: Android Learn Tab State Selection

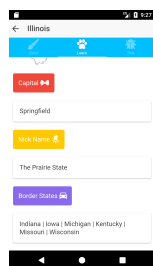


Figure 22: Android Learn Tab Selected State



Figure 23: Android Trek Tab State Colored

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